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Grouping pattern of ungulates in Benoue National Park and adjacent areas, Northern Cameroon

(Mammalia, Artiodactyla)

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Abstract

Data of average group sizes and group size frequencies are presented for 12 species from Benoue National Park and adjacent hunting zones 3 and 9. For waterbuck, roan, hartebeest, kob, bushbuck, reedbuck, oribi, Grimms duiker and red-flanked duiker more detailed in formation about composition of groups is given. The social organization revealed by the data generally goes conform with that of the same or closely related species known from other areas of Africa with the exception of the reedbuck. In this species the differences are thought to be caused by either different densities or different vegetation types.

1. Introduction

During a three years study of ungulate populations in Benoue National Park and adjacent areas, data were collected on group size and structure of several species. Since detailed information on all wildlife species in Western Africa is rather scarce, this paper should provide some elementary sets of data on the species concerned and should serve as a basic source of information against which future trends may be evaluated. Furthermore it should reveal differences, if there are any, from the results of similar studies from other areas in Africa.

2. Study area

All data presented here were collected from Benoue National Park and the hunting zones 3 and 9 to the east of the Park. The area comprises a surface of about 275 000 ha and is situated in Northern Cameroon about 100 km north of the Adamaoua Plateau. The vegetation, characterized as a post-fire climax community, consists of elements of both the Guinea and Sudan savanna. *Terminalia macroptera, T. laxiflora* savanna woodland, *Isoberlinia doka* woodland savanna, fringing forest dominated by *Anogeissus leiocarpus* and *Uapaca togoensis* dense woodland are the most important vegetation types. The grass layer is dominated by species of the tribus Andropogineae. General visibility varies con-

siderably and decreases from north to south, being best in *Terminalia laxiflora* shrub savanna on sandy soils and mature *T. macroptera* stands (up to 400 m) and poorest in *Uapaca togoensis* dense woodland (20–30 m). Climatic conditions are characterized by a dry (October/March) and a rainy season (April/September). From June to October/November most of the study area was not accessible due to bad road conditions. Field work was only possible after the first bushfires when the tall grass (up to 4 m) was burnt down.

Between the National Park and the hunting zones there are no major ecological differences with the exception that in the latter small scale subsistance farming by local people is performed. The whole area is infested by tsetse flies *(Glossina morsitans, G. palpalis)* except the extrem north which is tsetse free during the dry season.

The paper presents data on the following ungulate species: Giant Eland *(Taurotragus derbianus,* Gray); African Buffalo *(Syncerus caffer,* Sparrmann); Warthog *(Phacochoerus aethiopicus,* Pallas); Oribi *(Ourebia ourebi,* Zimmermann); Kob *(Kobus kob,* Erxleben); Grimms Duiker *(Sylvicapra grimmia,* L.); Red-flanked Duiker *(Cephalophus rufilatus,* Gray); Reedbuck *(Redunca redunca,* Pallas); Bushbuck *(Tragelaphus scriptus,* Pallas); Waterbuck *(Kobus ellipsiprymnus,* Ogilby); Roan *(Hippotragus equinus,* Desmaret); and Bubal Hartebeest *(Alcelaphus buselaphus,* Pallas).

Other species occuring in the area like Giraffe *(Giraffa carmelopardalis,* L.) and Korrigum *(Damaliscus lunatus,* Burchell) were not included as sample sizes were to small.

3. Methods

All roads shown in Fig. 1 were travelled along at irregular intervals from February 1976 to Mai 1978 except during the rainy season (see above). Two observers sitting on top of a vehicle driven at 20–30 km/h spotted, counted and sexed the animals. All recordings were noted immediately after the observation. Additional data were collected by counting animals on foot by traversing regular spaced transects laid out in the two hunting zones.

As already pointed out by LEUTHOLD et al. (1975) the main methodological problem associated with this type of work is to decide what is a group. This especially holds true for species living in large groups like eland, buffalo and kob and/or areas where detectability is low. The definition for a group given by LEUTHOLD et al. (1975) was found to be useful for this paper as it was applicable in most cases without problems. These authors define a group as "any number of animals found together at any point in space and time and apparently being in sensory contact with each other". Only those observations were considered for inclusion in this paper where one could assume with high certainty that all individuals belonging to that group or assemblage were recorded. In areas with very dense vegetation such as the fringing forest or parts of the *Uapaca* woodlands no observations were made.

Standard deviations of mean group sizes of all species are calculated from all single observations and not from grouped data as it is presented in Fig. 3 for eland and buffalo. Single animals are treated as groups throughout the text.

All groups whose members were counted, sexed and aged were classified into one of the following four types:

group I: all male groups irrespective of age
group II: all female groups with or without youngs
group III: one adult male with one or more females with or without youngs
group IV: mixed groups

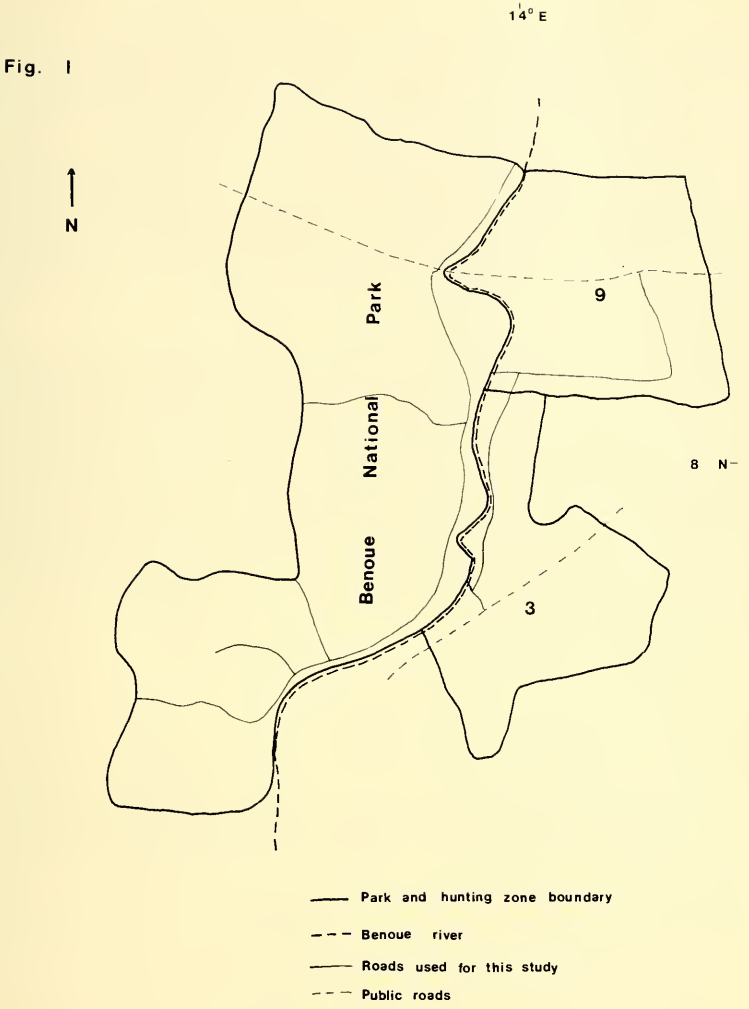

Fig. 1: Map of the study area

This classification follows LEUTHOLD et al. (1975). It is appropriate for all species included in this study as their expected social organization revealed by other studies should readily fit into this classification.

Waterbuck, roan and hartebeest were considered to be adult when they entered their third year of life, whereas bushbuck, kob and reedbuck were considered to be adult when they entered their second year of life. Oribi and both duiker species were only classified according to sex. As young all animals were classified which were less than one year old. As breeding season of all species, with the possible exception of eland, buffalo and kob is more or less seasonal, there were no problems in classifying animals as young or older than one year.

Mean group sizes were calculated from all groups observed regardless whether classified into one of the four group types or not. All data presented in Tab. 2 are only calculated from recordings of groups which were identified by numbers, sex and age according to the definitions given above. Although the amount of data of some species, e. g. both duikers and bushbuck, is rather small, they nevertheless were included as the results were somehow expected and more or less confirm the findings from other areas.

From December 1st to May 30th hunting is allowed in the hunting zones. Poaching pressure by local people probably is very high in the hunting zones. There is however, with one exception no evidence, that hunting activities do influence group size and structure, although at least legal hunting is highly selective as only adult males may be shot. BOSCH (1976) presumes that selective hunting is the reason why in Bouba Ndjida National Park in Northern Cameroon adult waterbuck are underrepresented in the population. For hunting zones 3 and 9 this could not be confirmed (ESSER, in press). If hunting pressure is not unproportionally high and quotas are established on a sound biological and ecological basis, hunting should not change grouping pattern as there is a continous interchange between the National Park and the hunting zones. In the beginning of this study it was planned to treat data from the two areas seperately to test this hypothesis but finally they were lumped together for the sake of sample size.

4. Results

Group sizes

Tab.I Mean group sizes (MGS) and standard deviations (SD) of twelve ungulate species in Benoue National Park and adjacent hunting zones 3 and 9

species	MGS	SD	total No. of groups
eland	15,5	16,3	37
buffalo	12,2	15,7	32
hartebeest	5,4	4,5	266
roan	4,o	3,7	91
waterbuck	4,2	3,2	247
kob	3,7	3,9	444
reedbuck	1,4	o,6	41
bushbuck	1,4	o,7	22
oribi	2,5	1,2	226
red flanked duiker	1,1	o,9	42
Grimms duiker	1,o	-	46
warthog	3,1	1,7	96

Fig. II

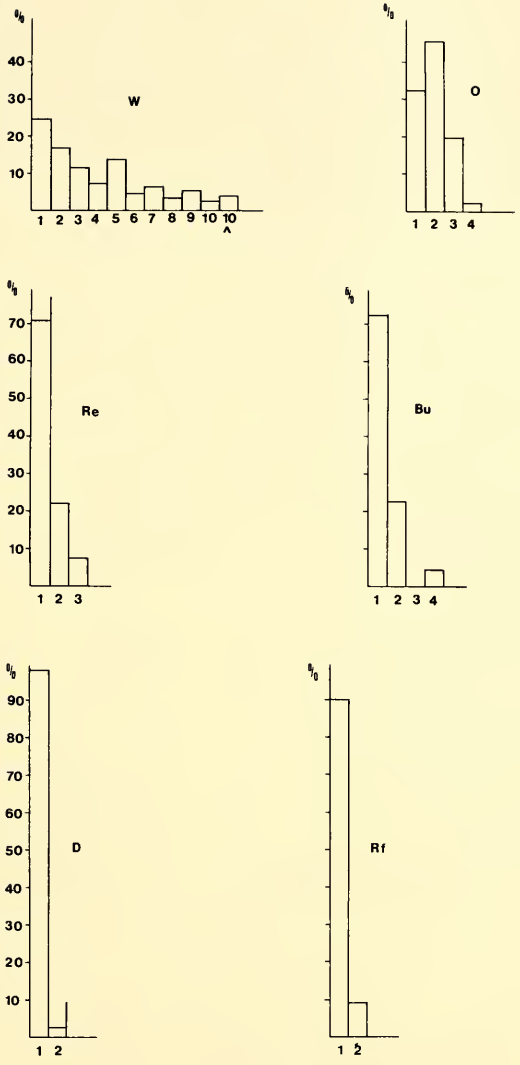

Fig. II: Group size frequency of waterbuck (W), oribi (O), reedbuck (Re), bushbuck (Bu), Grimms duiker (D), and red-flanked duiker (Rf).

Tab. 1 and Fig. 2 and 3 present data on group size for all species. Mean group sizes with standard deviations are given in Tab. 1, while Fig. 2 and 3 give the frequency distribution of group sizes. Maximum group sizes are given in Tab. 2 for nine species, for the remaining three species they are as follows: eland 85; buffalo 53; warthog 7. Mean group size is largest for eland and buffalo with 15,5 and 12,2 respectively and lowest for the two duiker species, bushbuck and reedbuck with 1,0; 1,1; 1,4; and 1,4 respectively. From the remaininig four species hartebeest has largest mean group size with 5,4 followed by waterbuck with 4,2, roan with 4,0 and kob with 3,7.

Fig. III

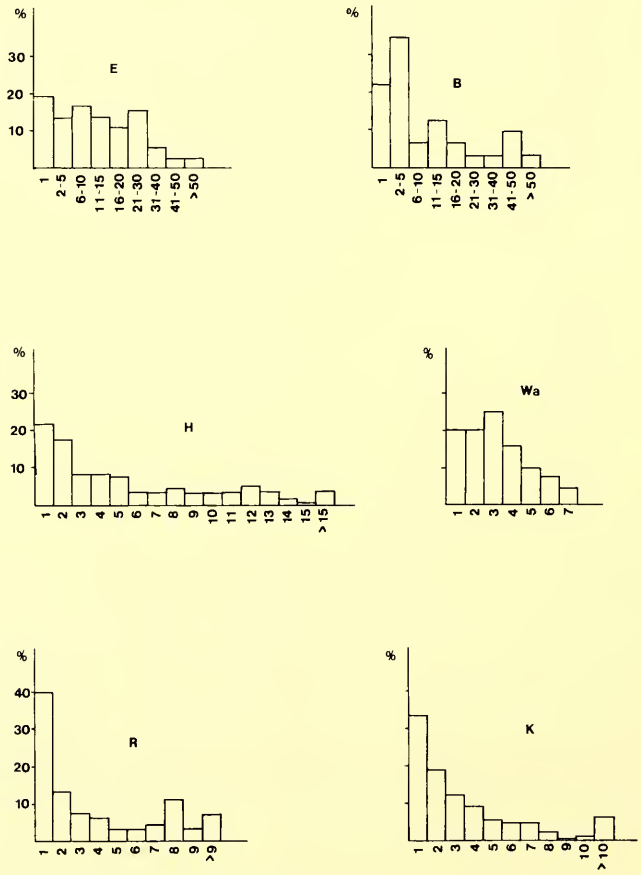

Fig. III: Group size frequency of eland (E), buffalo (B), hartebeest (H), warthog (Wa), roan (R), and kob (K).

Tab.II Size, composition, and frequencies of group types of ungulates in Benoue National Park and adjacent hunting zones 3 and 9

species	all male groups				all female groups			
		group size				group size		
	% of all groups	mean	max	% animals in group type	% of all groups	mean	max	% animals in group type
hartebeest	32,9	2,3	12	15,6	27,5	2,2	6	12,9
roan	63,2	1,4	4	27,1	1o,3	4,1	8	12,7
waterbuck	32,5	2,9	14	23,6	43,5	3,6	1o	39,1
kob	43,3	3,1	25	37,3	36,3	3,5	22	35,1
reedbuck	48,1	1,o	1	36,5	3o,8	1,2	2	26,9
oribi	16,8	1,2	2	8,8	16,9	1,3	3	11,4
bushbuck	23,8	1,o	1	17,2	71,4	1,5	4	75,8
Grimms duiker	47,2	1,o	1	45,9	52,8	1,1	2	54,1
red-flanked duiker	5o,o	1,o	1	47,1	5o,o	1,1	2	52,9

Tab.II (cont.)

1 ad. male and female herd

group size				mixed groups				
				group size				
% of all groups	mean	max	% animals in group type	% of all groups	mean	max	% animals in group type	total number of groups
36,2	11,6	22	65,7	3,4	8,2	13	5,8	149
25,o	7,6	16	56,8	1,5	8,o	8	3,5	68
16,5	5,6	1o	22,6	7,6	5,1	15	14,7	237
16,2	5,3	18	23,8	4,1	3,3	14	3,8	438
17,9	2,3	3	3o,8	2,6	3,o	3	5,8	39
64,9	2,4	4	78,1	1,4	3,o	4	1,7	181
4,8	2,o	2	6,9	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

Group types

Tab. 2 presents data on size and frequency of the four different group types. Omitted from this table are eland, buffalo and warthog. In eland and buffalo only two group types were observed (see below). In most cases however, it was rather difficult to sex and age these two species due to their shyness and/or their occurence in large groups. Sexing in warthog was in most cases impossible as sexual dimorphism is not well pronounced. For all other species all groups identified were classified into one of the four group types. However in bushbuck no mixed groups were observed while in both duiker species no groups of type III and IV were observed.

5. Discussion

The social organization of several species included in this study is sufficiently known. Most of this knowledge however comes from studies conducted in Eastern or Southern Africa. These studies include: hartebeest (Gosling, 1974); waterbuck (Kiley-Worthington, 1965; Spinage, 1969); reedbuck (Hendrichs, 1975); kob (Leuthold, 1966; Floody et al., 1975; Gerling et al., 1971; Wanzie, 1978); bushbuck (Waser, 1975); buffalo (Sinclair, 1977); roan (Joubert, 1974). From the above mentioned studies only those by Gerling et al. (1971) and Wanzie (1978) were carried out in Western Africa and these results have still to be considered as preliminary. Detailed information about the remaining five species is scarce, although there is general agreement about their basic social organization (Jarman, 1974; Estes, 1974).

Group sizes

Standard deviation for group sizes presented in Tab. 1 are for some species rather high. This reflects the wide range of group size and in some species the small sample size. Other species like bushbuck, oribi and both duiker species show very low standard deviations. This was somehow expected as they have a rather clear cut social organization and they usually live alone, in pairs or in family parties, which is demonstrated clearly by the frequency distribution of their group sizes (Fig. 2).

Somewhat surprising is the frequency distribution of reedbuck (Fig. 2). Over 70% of all individuals recorded were solitary animals of which about two thirds were males. This is in marked contrast to Hendrichs (1975) findings which clearly demonstrate that grouping pattern of this species is different in the Serengeti-Seronera area. Solitary animals accounted for only about 14% of the total population and group size varied from 1 to 14. These substancial differences may be influenced largely by the following facts. Reedbuck density in the study area is very low and is estimated at 0.3/km^2 (Esser, in press), in contrast to 12 to 21 animals/km^2 in Hendrichs study area. Sample size for reedbuck in this study is very low and therefore may not reflect the real situation. Similar results like those of this study for reedbuck are presented by Bosch (1976). He found that in Bouba Ndjida National Park reedbuck usually live solitary (44% of the total) or in pairs (37% of the total). These results indicate that there are regional differences in grouping pattern in this species. Leuthold et al. (1975) and Jarman (1974) give some evidence that at higher densities group size in some species like waterbuck, hartebeest and

zebra *(Equus burchelli böhmi,* Matchie) increases. A similar tendency could hold true for reedbuck, as in this species the mean group size is changed by a changing frequency distribution of group sizes. In the area with lowest density (study area) solitary animals (70% of the total) are most common and group size ranges from 1 to 4. In Bouba Ndjida National Park with a reedbuck density of about 3/km^2 (VAN LAVIEREN et al., 1980) solitary animals are still the most common group but decreased to 44% of the total, while the percentage of groups with two animals increased to 34% and group size ranges from 1 to 6. In the Serengeti-Seronera area the percentage of solitary animals decreased to 14% of the total but is still the most common group, whereas group size ranges from 1 to 14. Whether this difference in grouping pattern is only the result of changes in the species' density or a secondary effect caused by different vegetation types remains unknown.

Hartebeest, roan, waterbuck and kob have all rather large standard deviations of their group sizes, which is certainly due to their wide range. In kob the value is highest, which was expected as this species shows the highest tendency to concentrate around permanent waterplaces during the dry season thus forming large groups. During the wet season kob is more evenly distributed and therefore probably will show lower standard deviations of their group sizes. But this remains largely speculation as there is no proof for this assumption. Not expected was the relative low value for mean group size in kob as, except eland and buffalo, in this species the largest groups occured. The large groups are compensated for, however, by the high frequency of solitary animals. In waterbuck the standard deviation was expected to be higher. Here however no large concentrations were observed, which indicates that this species is probably less dependant on water than kob.

Little is known on the grouping pattern of warthog. Compared with data given by LEUTHOLD et al. (1975), the information presented by this study does not indicate any particularities.

As already stated above, eland and buffalo have very large standard deviations of their group sizes which is due to the high numerical variability of their groups. In both species only two group types were observed: mixed herds and herds which only consisted of males. In mixed herds individuals of all ages and both sexes were observed. These herds are considered to be breeding herds. In the all male herds no individuals were recorded younger than about two years judging from horn growth and body size. These herds were considered to be bachelor herds.

Group structure

Tab. 2 summarizes data of the four different group types. The first column under each type gives the percentage of this particular group type of the total number of groups, the second and third contain mean and maximum group sizes respectively, and the fourth gives the percentage of all animals belonging to that group type. The fourth column contains much of the biologically relevant information as it reveals trends about the social organization of the species.

In hartebeest, roan and oribi group type III is prevailing, i. e. harem groups in the first two species and family groups in the latter. In roan there is a very high percentage of all male groups which might be explained by the species tendency to avoid the formation of bachelor herds. More than 70% of the all male groups consisted of only one individual.

In hartebeest almost 60% of all male groups consisted of more than one individual. In this species the tendency of males to form bachelor herds is more pronounced as it obviously is in roan. In both species, roan and hartebeest, percentages of group types II and IV are relatively small which suggests that these two species have a rather distinct social organization in the study area. Oribi shows an even more distinct grouping pattern, as almost 80% of all individuals recorded live in family groups (1 ad. ♂; 1 ad. ♀ ± young).

In bushbuck a similar distinctness is evident. About 75% of all recorded animals live in group type II. All recorded groups of type I, almost 24% of the total, consisted of one animal only. In this species no mixed groups were observed and only one group of type III.

Waterbuck and kob show the least clear grouping pattern from all species dealt with in this paper. There is no group type which has a clear predominance of either the percentage of observed groups or the percentage of animals observed in that particular group.

Both duiker species show the same grouping pattern. In both species no groups of type III and IV were observed. Of all animals recorded one half belonged to group type I and the other half to group type II. All males observed were solitary. The same holds true for females, although on a few occasions females were accompanied by their youngs.

Interspecific groupings

On only a few occasions interspecific groupings were observed. They were limited to three species: kob, hartebeest and waterbuck. All these observations were made in the close vicinity of waterplaces. It is concluded therefore that these interspecific groupings were of accidential nature and not formed in an associative manner.

6. Conclusions

All data presented here necessarily reflect only the situation during the dry season. Whether and to what extent changes of group sizes and types do occur during the wet season remains largely unknown. From other areas changes between different seasons are documented (Leuthold et al., 1975; Jarman, 1974). There is some evidence which gives rise to the speculation that at least in some species there are differences in the social grouping in the course of the year in the study area. During January and February field data suggests an increase of solitary female hartebeest. From this species it is known that females do separate themselves before parturition from their social unit, but may be accompanied by a yearling which is most probably the offspring of the previous year. In the study area hartebeest is a strictly seasonal breeder and the peak lambing season occurs during January/February (Esser, in press), which may explain the unusual high frequency of solitary female hartebeests. In kob a similar phenomenon was noticed. It seems that during February/March solitary kob are more frequent than during the rest of the dry season. This trend may be explained by the fact that during this time the peak of rutting season occurs, although as Wanzie (1978) states, the species breeds throughout the year in this area. As in kob only territorial males participate actively in reproduction, during the peak rutting season more males try to establish territories and consequently

the proportion of solitary males of the total population increases. These observations may be regarded at the moment as a trend only since the amount of data is not sufficient to make a statistical treatment useful.

The data presented here necessarily can not show the real abundance pattern of the studied species. In this respect data of kob, waterbuck, both duiker species and bushbuck are biased. A relatively large proportion of the roads used for this study to record animals followed watercourses. Both waterbuck and kob concentrate during the dry season around permanent water, kob apparently more intensively than waterbuck, and therefore obtain a much higher detectability than species, which are less dependant on surface water. Hartebeest is considered the most abundant species in the area (ESSER, in press). Bushbuck and both duiker species have very specific habitat requirements. All three species prefer dense vegetation with well developed undergrowth. In the study area this requirement could only be met by the fringing forest and dense vegetation patches occuring occasionally around permanent waterholes or other relative moist places in savanna areas. As the roads did not adequately cover this vegetation type, these three species in fact should occur more frequently than the results of this study might suggest. Red-flanked duiker were never seen more than about 200m away from fringing forest areas. Bushbuck and Grimms duiker had a more patchy distribution since they used the dense vegetation patches occuring around the sporadic permanent waterholes in the savanna areas.

The results of grouping pattern summarized in Tab. 2 basically reflect the situation of the species from other areas. The only exception seems to be the reedbuck.

7. Literature

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